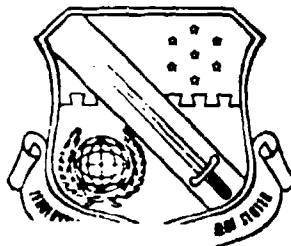


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OCTOBER 1985



**PERCEIVED PRODUCTIVITY: INTERACTION
EFFECTS OF GENDER, PERSONNEL
CATEGORY AND SATISFACTION WITH
TECHNICAL TRAINING**

AD-A160 886

MAJOR WILLIAM H. OAKLEY, USAF

OCTOBER 1985

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EXECUTIVE SUMMARY

REPORT NUMBER: LMDC-TR-85-8

AUTHOR: WILLIAM HENRY OAKLEY, MAJOR, USAF

TITLE: PERCEIVED PRODUCTIVITY: INTERACTION EFFECTS OF GENDER, PERSONNEL CATEGORY, AND SATISFACTION WITH TECHNICAL TRAINING

I. Purpose: To analyze the effect of sex, military personnel category, and satisfaction with technical training on perceived productivity. This was accomplished through a statistical analysis of the Air Force Leadership and Management Development Center (LMDC) Organizational Assessment Package (OAP) data base. The study merges previously separate topics and demonstrates the advantages of this merger to Air Force decision makers. The ultimate purpose is to better understand what factors influence productivity and possibly how to manipulate these factors to improve productivity within the Air Force.

II. Problem: Austerity, brought about by spiraling inflation and scarce resources, is a fact of life which cannot be ignored in today's Air Force. Since it is apparent that the budgetary floodgates will never be opened wide, we must attempt to optimize both individual and group productivity. In this way we can derive the greatest benefit from the resources we have. Unfortunately, not enough is known about either measuring or enhancing productivity for us to achieve these goals in a consistent manner. The OAP data base presents a unique opportunity to study perceived productivity and to see how such perceived productivity is influenced by factors such as satisfaction with technical training, sex, and military personnel category. Strong relationships, if established, could provide feedback to the training community, impact manpower decisions, and help Air Force decision makers at all levels.

III. Data: The data used in this study were collected by administering the OAP survey to over 45,000 Air Force personnel from all organizational levels and every major specialty area. The survey identifies existing strengths and weaknesses within organizational work groups. It provides LMDC personnel with a data base to facilitate consultation services to Air Force commanders, leadership training to Air Force personnel, and research programs which support the other functions. For the current study, perceived productivity was analyzed for differences across three levels of satisfaction with technical

training, between males and females, and between officer and enlisted personnel categories. Main effects and interaction effects between the variables were tested by use of a 2x2x3 factorial design.

IV. Results: The study confirmed statistically significant differences in perceived productivity across three levels of satisfaction with technical training (high, medium, low), between males and females and between officer and enlisted personnel categories. Further, there were significant ordinal interactions between satisfaction with technical training and sex, as well as between satisfaction with technical training and personnel category. There was no significant interaction observed between sex and personnel category nor among sex, personnel category, and satisfaction with technical training. Statistically, the aggregate results are consistent and interpretable. In terms of means, males always scored higher than females, officers always scored higher than enlisted personnel, and perceived productivity always increased as satisfaction with technical training increased.

V. Conclusions and Recommendations: The primary conclusion is that across a large sample population of Air Force personnel, satisfaction with technical training is associated with perceived productivity in the organizational environment. Further, this same satisfaction with technical training, because of its linkage with perceived productivity, may very well provide instructional technologists with strong feedback data with which to evaluate training programs. The size and heterogeneity of the sample population, however, may have obscured relationships which have greater practical significance within more homogeneous groups. Consequently, similar studies, looking at the same variables, should be performed within individual specialty areas. With the current study as a baseline, strong agreement could result in axiomatic rules which, if followed, could be used to enhance productivity and training effectiveness throughout the Air Force.

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CHAPTER I

INTRODUCTION

It is becoming increasingly clear that the Air Force is being asked to accomplish more with less. Shrinking budgets and expanding missions make the human resource even more important to achieving organizational goals. For this reason, the subject of enhancing individual productivity has received increased emphasis in recent years. A problem exists, however, in that we do not fully understand the determinants of productivity. This paper will address that problem by looking at the relationship between Air Force technical training and perceived productivity. By so doing, we hope to better understand what factors influence productivity and possibly how to manipulate these factors to improve productivity within the Air Force.

Need For The Study

The Leadership and Management Development Center (LMDC), Maxwell AFB AL, was created in 1975 as a result of recommendations by the Air Force Management Improvement Group. The LMDC charter established it as the focal point for providing better leadership and management education for AF personnel on a worldwide basis (Commander's Guide, 1979). Specifically, LMDC (a) provides management consultation services to AF commanders, (b) provides leadership and management training to AF personnel in their work environment, and (c) performs research in support of (a) and (b) (OAP Output, 1980). The Organizational Assessment Package (OAP) was developed by LMDC with cooperation from the Air Force Human Resources Laboratory to support these

objectives. The OAP survey provides a data base from which this research can be performed (Hendrix and Halverson, 1979). The need exists to determine the relationships between/among the OAP variables to increase the value of the results as a management tool. In this manner, consultants and commanders will better understand how to improve productivity within their organizations by looking at OAP survey results. Ultimately this relationship should be investigated between all variables of the OAP.

The current research, however, is aimed at analyzing those factors of the OAP involving Air Force technical training and perceived productivity (work group effectiveness) for both males and females and officer and enlisted personnel categories. Assuming significant relationships are found, the need also exists to discuss ways that Air Force productivity may be improved based on manipulation of the factors addressed. Information of this nature will serve all organizations who receive the output of technical training schools and should make the schools themselves more productive. Essentially, this study both serves a need to merge previously separate topics and to demonstrate the relationship and advantages of this merger to AF decision makers.

Assumptions

Certain assumptions, based on experience and a review of related literature (Chapter II), have been made in conducting this research. The first, a very strong one, is that perception of work group effectiveness, as measured by the OAP, is a valid indicator of both individual and group productivity. For this reason, perception of work group effectiveness and productivity will be considered synonymous and the terms will be used interchangeably. Secondly, we assume that the people surveyed are representative of their

units. Similarly, we assume that the units surveyed are representative of units throughout the Air Force. Third, we assume that the satisfaction a former student expresses toward his/her technical training is a valid measure of training effectiveness and further that the level of satisfaction does not change appreciably between the time training is completed and the time the OAP survey is administered. These assumptions recognize the fact that there are other factors which could explain certain relationships established in this study. Since this study, by its nature, is not a scientifically controlled experiment with control groups and careful elimination of other possible independent variables, we must evaluate the results based on the available data. Far from invalidating this study, this will narrow down the unknowns and provide a valuable point of departure for future studies. As a matter of fact, careful analysis of this nature implies much greater control and depth of observation than could normally be provided by a commander attempting to improve organizational productivity. These assumptions, as well as any limitations, will be discussed in greater detail in later chapters.

Research Hypotheses

The following hypotheses represent the expected results of this study:

1. There will be a difference in perception of work group effectiveness (perceived productivity) across the levels of satisfaction with technical training.
2. Males and females will differ in their perceived productivity.
3. Officer and enlisted personnel will differ in their perceived productivity.

4. There will be differences between the perceived productivity for males and females across the levels of satisfaction with technical training.
5. There will be differences between the perceived productivity for officer and enlisted personnel across the levels of satisfaction with technical training.
6. There will be differences between the perceived productivity for males and females across both military personnel categories (officer and enlisted).

As will be shown in Chapter II, information regarding the interaction of satisfaction with technical training, sex, and military personnel category is extremely limited. Available data are insufficient to support a specific hypothesis regarding the nature of this interaction in the present study. The interaction, however, will be tested as a part of the analysis and the results will be reported in Chapter IV and discussed in Chapter V as a basis for generating future research hypotheses regarding this potentially complex relationship.

CHAPTER II

REVIEW OF RELATED RESEARCH

A comprehensive subject search found virtually no information which specifically addressed the relationship between satisfaction with technical training and perception of work group effectiveness (much less including sex and personnel category). There is, however, sufficient material regarding the broad areas of training and productivity (Katzell & Yankelovich, 1975; Craig, 1976) to aid the analyses. This review is not intended to be an exhaustive study. It is designed only to examine enough of this related material to facilitate the analyses of the current hypotheses. As such, this review will discuss productivity and its measurement; how training effectiveness is measured; the relationship between training and productivity; and the differences which may be expected among the demographic variables of sex and military personnel category. It will conclude with a synthesis of the review.

Productivity and its Measurement

Productivity is difficult to both define and measure. Basically, to be productive means to yield results, benefits, or profits relative to the degree of input (Greenberg, 1973). Unfortunately, there are some common misunderstandings about exactly what productivity is. Greenberg (1973) states that even students of economics fail to understand the term. Productivity is not a measure of cost, although it is one component of cost; it does not measure the cost of a resource, but it is a measure of the relationship between quantity of resource used and quantity of output; it is not precisely a measure of efficiency, although it is often a good indicator of the efficiency with which some resource is being used.

Productivity, then, is the result of a combination of factors and is dependent on the interplay between them. This makes productivity difficult to measure and sometimes creates a tendency to define it as we wish it to be (Greenberg, 1973), or even to avoid defining it at all (Tolbert, 1976; White, 1977). Far from being a condemnation of other authors, this just emphasizes the difficulty of the problem. Katzell and Yankelovich (1975) found that as a matter of convenience people often looked at productivity in the broad sense of effective performance and measured it in terms of lack of job related problems rather than in strict productivity related terms. This tendency was particularly evident in complex organizations.

The Air Force faces the problem of being not only a complex organization, but also an organization whose output is a service rather than an easily quantifiable product. According to Fuchs (1969), this significantly compounds the problem of measuring productivity. Quantifying service output and obtaining data from the diverse activities found in a non-profit service organization are extremely difficult. This contributes to the pervading lack of understanding regarding productivity in the Air Force.

After identifying such a problem, this study would be remiss if it did not attempt to solve it. For our purposes a simple ratio will be used to define productivity: $\text{Output/Input} = \text{Productivity}$ (Greenberg, 1973). Although this does nothing to quantify either the input or the output, it clearly illustrates a relationship which will help in later analyses. As far as measuring the input and the output, conventional measures are beyond the capability of this project. For this reason, a different approach will be used. The current study will use perceived work group effectiveness as a

measure of productivity. This data, obtained from a large sample of AF personnel, may be the only common thread to measuring productivity in a complex service organization such as the Air Force.

Measuring Training Effectiveness

By the same token, measurement of training effectiveness is often as nebulous as the measurement of productivity. According to AFM 50-2, Instructional System Development (1979), the goal of training is to produce a fully qualified graduate at the lowest possible cost. To this end, in November of 1970, the AF Chief of Staff directed that Instructional System Development (ISD) be applied to all new AF instructional programs and to existing training where economically feasible (ISD Executive Summary, 1978).

As the name implies, ISD is a systems approach to training program development. The process consists of five steps. At step 1, all tasks necessary to operate the weapon system (or whatever function you want to train) are determined. At step 2, the knowledge and skills necessary to operate the system are determined. This is what specifically must be trained. At step 3, the daily objectives are established and tests are developed which will evaluate whether the student has attained the objectives. Step 4 involves creating the training program with all the supporting materials and then validating the training. The final step involves actually conducting the training and continually evaluating the program after it is implemented (AFM 50-2, 1979). The current research will deal with the last two steps of this process in greater depth.

The actual design of the training program occurs at step 4. The methodology selected is that which best supports the achievement of objectives developed at step 3 of the process. It is essentially the integration and

and use of this methodology that a student evaluates when he critiques a course. The first actual input the student has to the process is during the validation stage of step 4. At this point in the ISD process considerable resources (time and money) have been expended and the commitment caused by these expenditures may negate any major changes to a training program based on student input.

This observation is also significant as we look at step 5 of the process. It is here that we apply both internal and external evaluation techniques to provide feedback into the various steps of the ISD process. Feedback is an ongoing evaluation which is applied throughout the life cycle of the training program. It is this researcher's experience that we tend to overlook student feedback in favor of more objective data such as test item analyses. Nixon (1973) points out that a course developer must keep in mind the total process of human resource development and the interplay of inter-related parts within the whole. The Air Force Inspection and Safety Center (1978) found that this was not being done. Their findings show that two-thirds of the units visited during their Functional Management Inspection of Instructional System Development did not have an effective evaluation program to measure the job relevancy of the instruction or its cost effectiveness. In one-half of the units visited, field evaluation of graduates and supervisors was not being performed.

It is apparent that the answer to such questions as "What is good?", "How much is enough?", and "How do you know?", have not been answered (Nixon, 1973). Looking at productivity from the aspect of satisfaction with technical training may help to fill the gap. If student satisfaction with technical training does reflect future productivity, we may have found one answer to Nixon's questions as well as a means to effectively evaluate AF training programs.

The Relationship

It is generally accepted that training is required to learn the skills necessary to do most complex jobs. Whether learning takes place through formal academic training, on the job training, or informal observation and practice, development of the human resource is paramount to productivity in any organization (Nixon, 1973; Vermilya & Wilkerson, 1980). There is, however, a basic misunderstanding among supervisors and managers. The apparently obvious nature of the relationship between training and productivity is often misleading.

When confronted with a problematic situation, many commanders and supervisors developed training programs, requested one be developed, or sent personnel to available training courses, without sufficient analysis. Consequently, training became the means by which the problem was supposedly solved; yet, the cause and solution most often were in the management, supervision, or technical data areas. (AFISC TIG Report, 1978, p. 11).

A similar problem exists on the training side of the house.

"Instructional requirements were being formulated without a thorough analysis of job performance requirements, technical data, and user information. Training devices and audiovisual equipment/materials were identified without thoroughly determining the purposes" (AFISC TIG Report, 1978, p. 2).

In other words, everybody knows that there is a relationship but not enough people understand what the relationship is. Mager (1970) tries to shed some light on the problem. He states that if lack of skill is the problem and the individual has what it takes to learn the skill, then training can be the solution to proper human resource development. If skill is not the problem, the difficulty could lie in the nature of the task (e.g., nonperformance may be rewarding) or there may be other obstacles to effective

performance (poor management, working conditions, etc.). The actual decision to use training to increase productivity must depend on the nature of the problem and the cost of correcting it. Knowledge of the relationships being investigated by this study will help in making this decision.

Demographic Variables

As we try to better understand the determinants of productivity, it helps to look at the differences that may exist between male and female, and officer and enlisted personnel in regard to their perceptions of work group effectiveness. This is particularly significant as we look at the expanded involvement of women in the AF during the last decade (academy appointments, pilot training, missile training). Fortunately, there is a study which compares the differences between/among our demographic variables. Hamilton and Short (1980) studied the interaction effects of sex, duty location, and personnel category on perceived productivity. Their study did show a difference between sexes and military personnel categories on perceived productivity. Specifically, males scored higher than females and officers scored higher than enlisted personnel. This data provides us with baseline information for comparison when the analysis is performed during the current study.

Synthesis

The review of related research shows that the term productivity is seldom used clearly or consistently even in professional literature. Sometimes it is used in a broad, all-inclusive sense to mean overall performance, and

sometimes in a narrower sense of output per unit of time or cost. In either case, productivity is hard to measure in a heterogeneous service organization such as the Air Force. Consequently, many people are satisfied to think of productivity in the broad sense of effective performance. This sometimes implies lack of problems such as absenteeism or job related accidents more than strict productivity related measures (Katzell & Yankelovich, 1975). Similarly, there is a lack of understanding regarding how to measure the effectiveness of training programs. In both instances the studies cited do more to identify the problem than to solve it. Contrasted to this situation, there appears to be no question in most people's minds regarding the importance of training to productivity. A survey conducted by Katzell and Yankelovich (1975) found that training was considered to be one of the most important determinants of productivity in the minds of the respondents. Unfortunately, the nature of the relationship is less clear. The light at the end of the tunnel may be provided by the OAP and the body of data which has been accumulated from administering this survey to over 60,000 respondents. If we can establish definitive conclusions based on our statistical analysis of this data, it will answer many of these questions and will provide meaningful information for use by LMDC consultants and AF decision makers.

CHAPTER III

APPROACH AND METHODOLOGY

This chapter will describe the approach and methodology which was used to determine the interaction effects of training, sex, and personnel category on perceived productivity. It will include statements of the null hypotheses, a description of the Organizational Assessment Package, a description of the subjects, and a description of the statistics used to analyze the data.

Statement of Null Hypotheses

The following null hypotheses will be statistically tested by this study:

1. There will be no difference in perception of work group effectiveness (perceived productivity) across the levels of satisfaction with technical training.
2. Males and females will not differ in their perceived productivity.
3. Officer and enlisted personnel will not differ in their perceived productivity.
4. There will be no differences between the perceived productivity for males and females across the levels of satisfaction with technical training.
5. There will be no differences between the perceived productivity for officer and enlisted personnel across the levels of satisfaction with technical training.

6. There will be no differences between the perceived productivity for males and females across both military personnel categories (officer and enlisted).

7. There will be no three way interaction among sex, military personnel category, and technical training.

Instrumentation

The Organizational Assessment Package (OAP) was designed to support the mission objectives of the Leadership and Management Development Center, Maxwell AFB AL.

It provides a means of identifying existing strengths and weaknesses within organizational work groups and aggregated work groups such as directorates. The research results can be fed into Professional Military Education curricula; other leadership and management training courses; and when action is required, to Air Staff and functional offices of primary responsibility. Additionally, the data base established by the OAP can be used to strengthen the overall AF organizational effectiveness program through research.
(OAP Output, 1980, p.1)

The survey consists of a 109 question booklet and a response sheet. Section One of the response sheet gathers demographic information such as sex and personnel category; those variables of interest to this study. Work group productivity, our dependent variable is surveyed by questions 77-81 (Figure 1).

WORK GROUP PRODUCTIVITY

The statements below deal with the output of your work group. The term "your work group" refers to you and your co-workers who work for the same supervisor. Indicate your agreement with the statement by selecting the phrase which best expresses your opinion.

- | | |
|-------------------------|--------------------------------|
| 1 = Strongly disagree | 4 = Neither agree nor disagree |
| 2 = Moderately disagree | 5 = Slightly agree |
| 3 = Slightly disagree | 6 = Moderately agree |
| | 7 = Strongly agree |

Select the corresponding number for each statement and enter it on the separate response sheet.

- 77. The quantity of output of your work group is very high.
- 78. The quality of output of your work group is very high.
- 79. When high priority work arises, such as short suspenses, crash programs, and schedule changes, the people in my work group do an outstanding job in handling these situations.
- 80. Your work group always gets maximum output from available resources (e.g., personnel and material).
- 81. Your work group's performance in comparison to similar work groups is very high.

Figure 1. OAP Items

Satisfaction with technical training is surveyed by question 105 (Figure 2). For purposes of this study, the responses will be categorized in three levels (low corresponds to responses 1, 2, and 3; medium corresponds to responses 4 and 5; high corresponds to responses 6 and 7).

JOB RELATED ISSUES

The items below are used to determine how satisfied you are with specific job related issues. Indicate your degree of satisfaction or dissatisfaction with each issue by choosing the most appropriate phrase.

- | | |
|--|--------------------------|
| 1 = Extremely dissatisfied | 5 = Slightly satisfied |
| 2 = Moderately dissatisfied | 6 = Moderately satisfied |
| 3 = Slightly dissatisfied | 7 = Extremely satisfied |
| 4 = Neither satisfied nor dissatisfied | |

Select the corresponding number for each question and enter it on the separate response sheet.

105. Technical training (Other than OJT)

The technical training I have received to perform my current job.

Figure 2. OAP Items

The dependent variable of work group effectiveness and the independent variables of satisfaction with technical training, sex, and military personnel category will be statistically analyzed.

Subjects

The statistical sample consisted of 45,622 respondents to the OAP survey. There were representatives from all organizational levels and every major Air Force specialty area. Table 1 shows the breakdown in each category of concern.

Table 1

Subject Breakdown by Category

	Male	Female	Row Total
Officer	6,780 (90.2%)	738 (9.8%)	7,518 (16.5%)
Enlisted	33,956 (89.1%)	4,148 (10.9%)	38,104 (83.5%)
Column Total	40,736 (89.3%)	4,486 (10.7%)	45,622 (100%)

Method of Data Analysis

To test the null hypotheses, an analysis of variance was performed using a 2 (personnel category) x 2 (sex) x 3 (level of satisfaction with technical training) factorial design. Differences between/among the various cells were considered statistically significant at the $p \leq .05$ level of significance. Differences that are statistically significant at or beyond this level are considered interpretable for use in determining implications and conclusions of this study.

CHAPTER IV

RESULTS OF ANALYSIS

This chapter presents the results of the analysis performed in accordance with Chapter III, Approach and Methodology. The result of testing each null hypothesis is provided in a separate section. Comprehensive data is displayed for each null hypothesis which was rejected (research hypothesis confirmed). A null hypothesis was rejected at least at the $p \leq .05$ level of significance. Data involving those null hypotheses we failed to reject are provided on a limited basis only to the extent that it will help interpret the study results. There may be minor differences in the numbers provided for the hypotheses dealing with the main effects versus those provided for the interaction effects because of the way data are categorized. Table 2 provides the analysis of variance summary table with data from the entire study.

Table 2
Analysis of Variance Summary Table

Source of Variation	Sum of Squares	df	Mean Square	F	Significance of F
Main Effects					
V712 (a)	6348.223	2	3174.111	2116.910	0.000 ***
PERCAT (b)	296.734	1	296.734	197.901	0.000 ***
SEX	13.903	1	13.903	9.272	0.002 **
2-Way Interactions					
V712 - PERCAT	43.486	2	21.743	14.501	0.000 ***
V712 - SEX	16.020	2	8.010	5.342	0.005 **
PERCAT - SEX	2.379	1	2.379	1.586	0.208 ns
3-Way Interactions					
V712-PERCAT-SEX	5.615	2	2.808	1.872	0.154 ns
* $p < .05$ a Satisfaction with Technical Training ** $p < .01$ b Personnel Category *** $p < .001$					

Null Hypothesis 1: There will be no difference in perception of work group effectiveness (perceived productivity) across the levels of satisfaction with technical training. This null hypothesis was rejected. The data, shown in Table 3, consist of the mean score (\bar{x}) on factor 821 (perceived productivity), the number of samples in each cell (N), and the standard deviation (SD). These figures are displayed for three levels (low, medium and high) of respondent satisfaction with technical training. The means are graphed in Figure 3. The analysis of variance test for main effect (Table 2) was significant ($p < .001$). Based on our $p \leq .05$ standard, we conclude that a significant difference in perceived productivity exists between at least two of the three levels of satisfaction with technical training. Following a procedure outlined by Winer (1962), subsequent pair-wise comparison showed significant differences between pair-wise comparisons possible among the three levels. Further, although we were not testing for relationship, it is interesting to note that there was an increase in perceived productivity as satisfaction with technical training increased.

Table 3

Perceived Productivity Score by Satisfaction With Technical Training

	Low	Medium	High
\bar{X}	4.93	5.35	5.92
N	11,697	14,194	14,447
SD	1.45	1.20	1.05

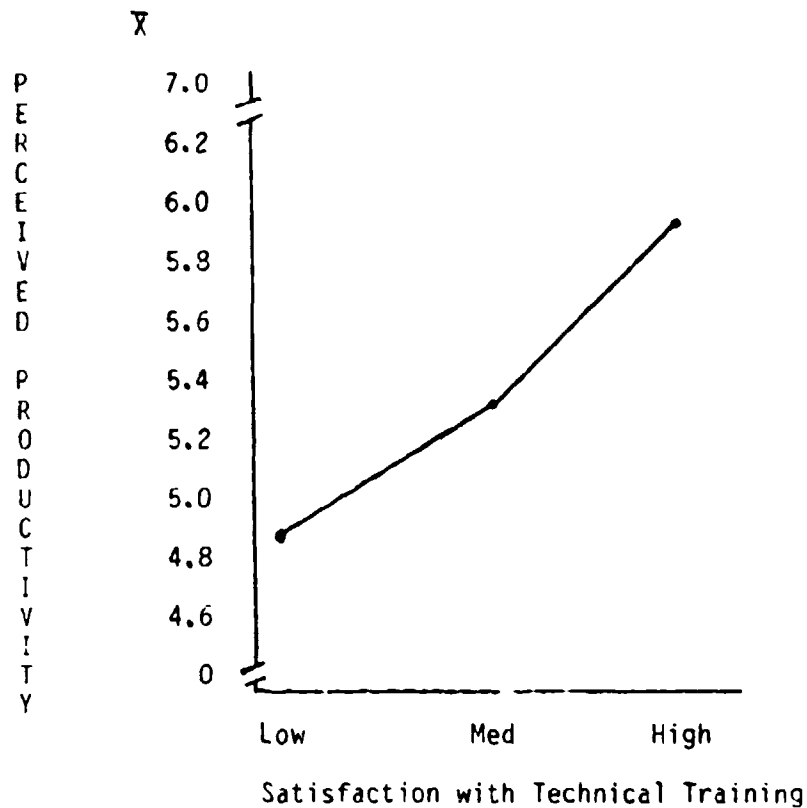


Figure 3. Perceived Productivity Score by Satisfaction With Technical Training.

Null Hypothesis 2: Males and females will not differ in perceived productivity. This was also rejected. The data, displayed in Table 4 and graphed in Figure 4, consist of the mean perceived productivity score, number, and standard deviation arranged by sex. In this instance, results of the analysis of variance main effect test showed that males scored significantly higher than females ($p < .01$) in mean perceived productivity.

Table 4

Perceived Productivity Score by Sex

	Male	Female
\bar{X}	5.44	5.35
N	36,178	4,160
SD	1.29	1.30

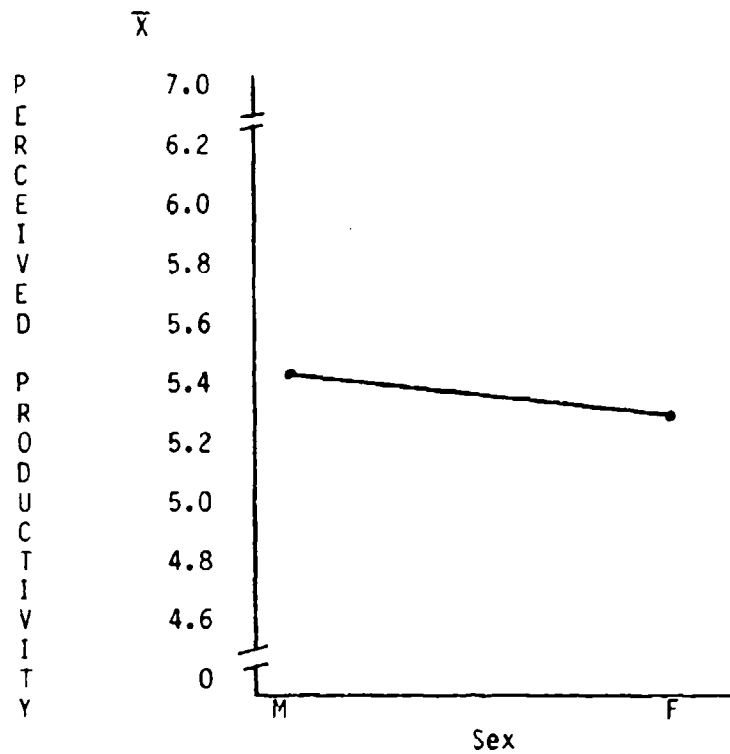


Figure 4. Perceived Productivity Score by Sex.

Null Hypothesis 3: Officer and enlisted personnel will not differ in perceived productivity. This null hypothesis was rejected. The data, displayed in Table 5 and graphed in Figure 5, consist of mean score on perceived productivity, number, and standard deviation, arranged by military personnel category. The results of this analysis showed that officers scored significantly higher in mean perceived productivity than the enlisted personnel ($p < .001$) who participated in the OAP survey.

Table 5

Perceived Productivity Score by PERCAT

	Officer	Enlisted
\bar{X}	5.69	5.39
N	6,410	33,928
SD	1.14	1.31

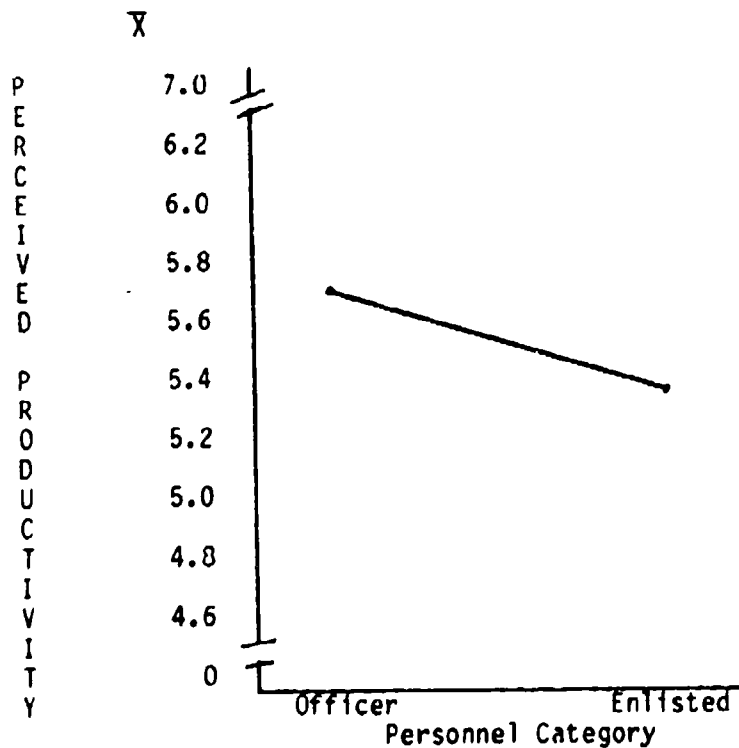


Figure 5. Perceived Productivity Score by PERCAT.

Null Hypothesis 4: There will be no differences between the perceived productivity for males and females across the levels of satisfaction with technical training. This null hypothesis was also rejected ($p < .01$), thus confirming an interaction effect for males and females across the levels of satisfaction with technical training. Table 6 and Figure 6 display the results of the analysis. In addition to the significant interaction between sex and satisfaction with technical training, we note an increase in mean similar to that observed in testing null hypothesis 1. This is expected; however, we also observe an ordinal relationship between the male and female responses. The mean scores do not change order (cross) along all levels of satisfaction with technical training. In all cases males scored equal to or higher than females when the statistics were carried to two decimal places. When taken to four decimal places, males scored slightly higher than females (5.3545 for males versus 5.3514 for females) at their nearest point on the graph (medium level of satisfaction).

Table 6

Perceived Productivity Score by Satisfaction With Technical Training and Sex

Tech Tng		Male	Female	Row Total
Low	\bar{X}	4.93	4.90	4.93
	N	10,417	1,280	11,697
	SD	1.45	1.45	1.45
Medium	\bar{X}	5.35	5.35	5.35
	N	12,691	1,503	14,194
	SD	1.20	1.16	1.20
High	\bar{X}	5.94	5.78	5.92
	N	13,070	1,377	14,447
	SD	1.04	1.14	1.05
Column Total	\bar{X}	5.44	5.35	5.44
	N	36,178	4,160	40,338
	SD	1.29	1.30	1.29



Figure 6. Perceived Productivity Score by Satisfaction With Technical Training and Sex

Null Hypothesis 5: There will be no differences between the perceived productivity for officer and enlisted personnel across the levels of satisfaction with technical training. This null hypothesis was rejected ($p < .001$), thus confirming a significant interaction between levels of satisfaction with technical training and military personnel category. Table 7 and Figure 7 display the results of the analysis. Again, there is an increase in mean score along increasing levels of satisfaction with technical training and an ordinal relationship with officers scoring higher at all levels than enlisted personnel.

Table 7

Perceived Productivity Score by Satisfaction With Technical Training and PERCAT

Tech Tng		Officer	Enlisted	Row Total
Low	\bar{X}	5.22	4.89	4.93
	N	1,499	10,234	11,733
	SD	1.32	1.46	1.45
Medium	\bar{X}	5.59	5.31	5.35
	N	2,289	11,950	14,239
	SD	1.10	1.21	1.20
High	\bar{X}	6.03	5.90	5.92
	N	2,635	11,849	14,484
	SD	0.93	1.08	1.05
Column Total	\bar{X}	5.69	5.39	5.43
	N	6,423	34,033	40,456
	SD	1.14	1.31	1.29

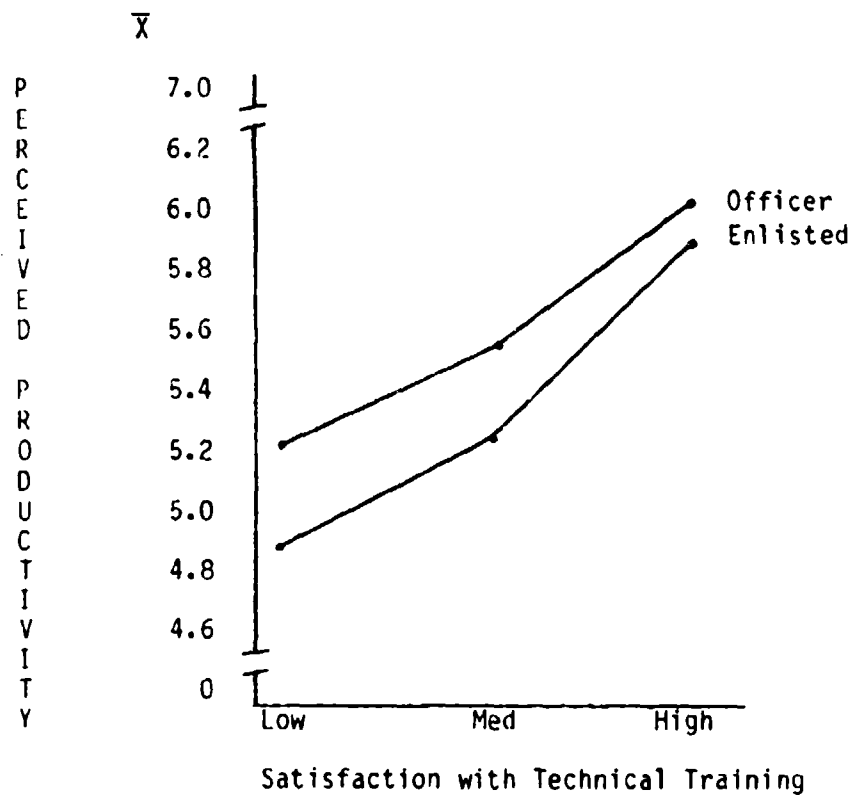


Figure 7. Perceived Productivity Score by Satisfaction With Technical Training and PERCAT

Null Hypothesis 6: There will be no differences between the perceived productivity for males and females across both military personnel categories (officer and enlisted). We failed to reject this null hypothesis ($p > .05$). We therefore must conclude that there was, in fact, no interaction effect of sex by personnel category in the OAP sample. Table 8 and Figure 8 display this data.

Table 8

Perceived Productivity Score by Sex and PERCAT

	Tech Tng	Officer	Enlisted	Row Total
Male	\bar{X}	5.71	5.40	5.45
	N	6,516	31,621	38,137
	SD	1.13	1.32	1.29
Female	\bar{X}	5.54	5.33	5.36
	N	693	3,767	4,460
	SD	1.20	1.31	1.29
Column Total	\bar{X}	5.69	5.39	5.44
	N	7,209	35,388	42,597
	SD	1.14	1.31	1.29

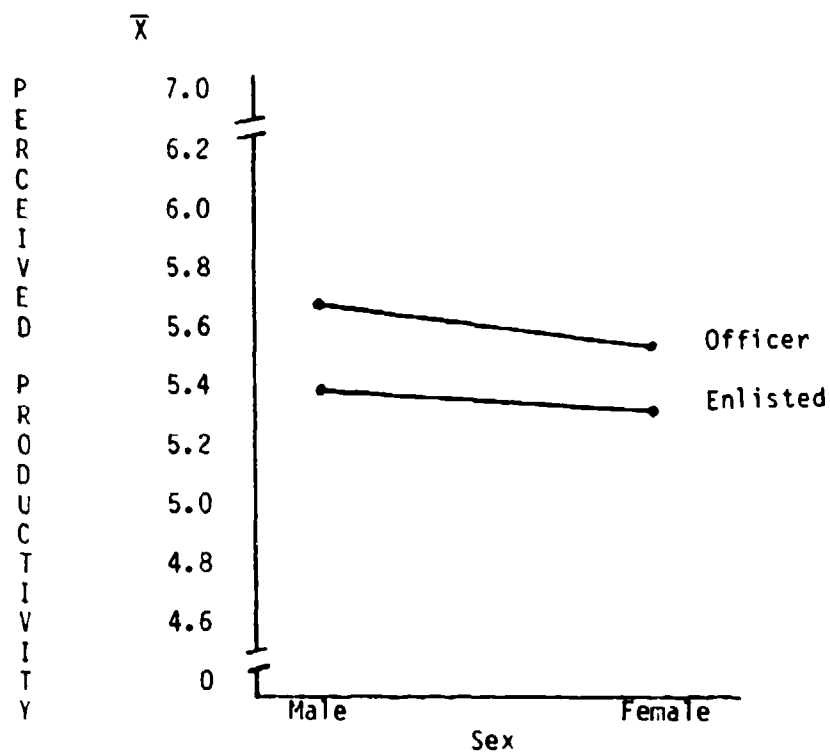


Figure 8. Perceived Productivity Score by Sex and PERCAT

Null Hypothesis 7: There will be no three-way interaction among sex, military personnel category, and satisfaction with technical training. We also failed to reject this null hypothesis ($p > .05$). Since this null hypothesis does not correspond to a stated research hypothesis and because no interaction effect was observed, specific data will not be provided on the results of this test. Subsequent discussion in Chapter V will center only on the main effects and the two-way interactions.

Summary

The results of the statistical analysis performed during this study confirmed significant statistical main effects for satisfaction with technical training (Variable 712), personnel category, and sex; and significant ordinal interaction effects between Variable 712 and sex, as well as between Variable 712 and military personnel category. There were no two-way interaction effects between sex and personnel category and no three-way interaction effects among Variable 712, sex, and personnel category. Those effects/interactions which were significant caused us to reject null hypotheses 1 through 5. We failed to reject null hypotheses 6 and 7. The significant results are considered interpretable and are discussed in Chapter V.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The analysis portion of this study confirmed the following research hypotheses through rejection of the corresponding null hypotheses:

1. There will be a difference in perception of work group effectiveness (perceived productivity) across the levels of satisfaction with technical training.
2. Males and females will differ in perceived productivity.
3. Officer and enlisted personnel will differ in perceived productivity.
4. There will be differences between perceived productivity for males and females across the levels of satisfaction with technical training.
5. There will be differences between perceived productivity for officer and enlisted personnel across the levels of satisfaction with technical training.

There was no two-way interaction effect between sex and personnel category, nor a three-way interaction among sex, personnel category, and satisfaction with technical training. This chapter will discuss these results, concentrating on the significant findings. We will begin by discussing the limitations of the study, then the significant results, and finally any conclusions and recommendations.

Limitations

There were some limitations of this study which affect the discussion of any results. First, even though we found some significant effects, and interesting relationships between the variables of the study, this does not

necessarily imply a direct cause and effect relationship. Our findings may be manifestations of other variables which could not be controlled. This lack of control is the second limiting factor which should be kept in mind. It will become the basis for some recommendations for further study. Lastly, this study was constrained by both the data base and the survey instrument by which the data were collected. The assumptions which were made in Chapter I partially acknowledged this fact. Specifically, substitute measures of productivity and training effectiveness were used. Also there were not equal numbers of samples in each cell of the analysis. Both of these factors impact the interpretation of the statistical results. These limitations do not at all decrease the value of this study; they are included strictly as an aid to interpreting the findings.

Discussion

Null hypothesis 1 was rejected. Therefore, by implication, research hypothesis 1 was confirmed within chance variations. The statistical analysis showed that there was a significant difference in perceived productivity across all levels of satisfaction with technical training. The numerical difference between the mean of perceived productivity at the highest and lowest levels of satisfaction, however, was only .99 on a seven point scale. This difference, although statistically significant, raised questions in this researcher's mind regarding the practical significance of the results because of what appeared to be relatively small differences between the individual means compared to the scale size and the statistical sample size. Consequently, each statistically significant main effect difference was evaluated for practical significance. To be practically significant, the difference between the respective means needed to be greater than

approximately $1/2$ of the grand standard deviation (1.29). The figure used for comparison was .6. While not a stringent statistical procedure, this "interpretive" type of analysis helped determine whether or not statistically significant differences were also practical and useful. By applying this interpretive test, it is interesting to note that the difference between the highest (5.92) and lowest (4.93) means represented practical significance. Differences between the mean at the medium level of satisfaction (5.35) and either the higher or lower means did not represent practical results. It is also interesting to note that as satisfaction with technical training increased, so did perceived productivity. Although this relationship was not statistically analyzed by the current study, a finding of this nature certainly helps establish a useful relationship between the two variables. The combination of this relationship along with the statistical and practical differences outlined earlier appears meaningful. Whether these results are attributable to a direct cause and effect relationship or manifestations of other variables (such as motivation, personality, etc.), they add to our knowledge of both training and productivity, and will serve to be reciprocally beneficial to students of both disciplines.

Null hypothesis 2 was also rejected. Males and females did, in fact, differ significantly in their mean perceived productivity score. The interpretive test in this instance did not confirm practical significance because the difference between the means, while statistically significant, was relatively small (.09). Either way, care should be taken in drawing inferences from this data. Further interpretation should be deferred pending discussion of the remaining results. The additional perspective will add to our understanding.

By the same token, null hypothesis 3 was rejected, thus confirming the corresponding research hypothesis. There was a significant difference in perceived productivity between officer and enlisted personnel categories. In this instance officers scored .4 higher than enlisted personnel. Even though this does not constitute practical results by itself, what is particularly intriguing is that all three main effects displayed some degree of statistical significance. This becomes more important as we look at the interaction effects.

The statistical analysis of null hypothesis 4 caused its rejection due to a significant ordinal interaction between males and females across all levels of satisfaction with technical training. The fact that males scored higher (even if marginally) than females at all levels, and that the means increased as satisfaction with technical training increased, was predictable based on the results of testing hypotheses 1 and 2. A glance at Figure 6 shows that the slope of the line for females does not change appreciably along the levels of satisfaction with technical training, but that it increases noticeably for males at the highest level of satisfaction. Perhaps self-image and societal pressures account for the differences. It is clear from the shape of the curves, however, that the source of the interaction appears more due to enhancement in male perception at higher levels than to a disparity in the perception of females. To speculate further would call for conclusions beyond the scope of this study.

Finally, in testing null hypothesis 5, the statistics showed a difference in perceived productivity for officer and enlisted personnel categories across the levels of satisfaction with technical training. These results, by implication, confirmed research hypothesis 5. Again there is an ordinal

interaction (Figure 7), with increasing means which correspond to increasing levels of satisfaction with technical training. The officers always score higher than the enlisted personnel, however the difference narrows noticeably at the highest level of satisfaction. The major cause of this interaction appears to be a disproportionate increase in the enlisted mean score at this high level. It is possible that this reflects an overall higher capability and level of motivation on the part of the enlisted students that express high levels of satisfaction with technical training. Since the enlisted personnel category is not as homogeneous as the officer category in terms of educational background and capabilities, it is logical to this researcher that the OAP survey responses could reflect such differences within the enlisted personnel category.

It is important to point out that the two-way interactions that we just observed may reflect perturbations caused by our inability to control for all possible factors which could influence the results. Of course, a perfectly controlled study which failed to reflect reality within the Air Force would not be very practical. Supervisors have very little control over these same factors. This study, then, is an accurate reflection of the environment which current Air Force leaders face. Further, this discussion alluded to such terms as motivation, societal pressures, and self-image to suggest possible reasons for the results which were obtained. Without attempting to turn this paper into a study of social or motivational psychology, these ideas were provided only to spur the imagination of the reader. The fact that no two-way interaction was found between sex and personnel category (research hypothesis 6), however, tends to support the existence of this type of factor which is manifested only when looking at

a subjective measure such as satisfaction with technical training. It is exactly this subjective type of measurement which is likely to illuminate such psychological factors.

Conclusion

The aggregate results of this study are consistent and interpretable. In terms of means, males always scored higher than females, officers always scored higher than enlisted personnel, and perceived productivity always increased as satisfaction with technical training increased. Added to this statistical significance, from a practical standpoint there was also a meaningful difference in perceived productivity between the high and low levels of satisfaction with technical training. When we look at the voids in our ability to directly measure either training effectiveness or productivity, the tendency to overreact to the positive results of this study is strong. Caution must be used, therefore, to place these conclusions in the proper perspective. This study goes a long way toward improving our understanding of variables surveyed in the OAP. It has also gone a long way toward improving our understanding of both training measurement and productivity measurement. What it hasn't done, primarily because of the lack of practical significance in differences between all of the means, is actually give us an inviolable measure of either training effectiveness or productivity. This fact does not diminish the value of this study at all. It is emphasized only to insure that the current results are properly interpreted.

Recommendations

The current study constitutes the first step toward merging the previously separate topics of satisfaction with technical training and perceived productivity. A more complete understanding of the relationship between these topics would benefit Air Force decision makers at all levels. Further investigation, however, would have the most immediate impact on individual work centers and on the training community. In order to realize these benefits additional studies should be performed. In particular, those items which were presented as assumptions during the current study should be verified. Secondly, it is this researcher's opinion that one of the strengths of this study, the large sample population, was also one of its weaknesses. This large population possibly obscured highly significant relationships in more homogeneous groups. The same variables which were investigated in the current study should be examined within particular specialty areas. Verification of the current results would validate their use as guidelines for constructing and modifying training programs and for enhancing productivity. Differences in results, such as disordinal interactions or decreasing perceived productivity levels along increasing levels of satisfaction, may be symptomatic of problems which require immediate attention.

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